

## WHAT IS CLAIMED IS:

1. A method for single molecule identification of a target DNA molecule in a random coil state comprising the following steps:

a) attaching an optically distinguishable material to a DNA sequence recognition unit;

b) hybridizing said DNA sequence recognition unit to said target DNA molecule in a random coil state to form a hybridized DNA complex in a random coil state;

c) stretching said hybridized DNA complex in a random coil state to form a hybridized DNA complex in a substantially linear configuration; and

d) detecting said optically distinguishable material in a sequential manner along said substantially linear hybridized DNA complex, thereby identifying said target DNA molecule.

2. The method of claim 1 wherein said optically distinguishable material comprises colored microparticles.

3. The method of claim 1 wherein said optically distinguishable material comprises microparticles having different shapes.

4. The method of claim 2 wherein said colored microparticles comprise dyes, dye aggregates, pigments or nanocrystals.

5. The method of claim 1 wherein said DNA sequence recognition unit comprises DNA, DNA fragments, synthetic oligonucleotides or peptide nucleic acids.

6. The method of claim 1 wherein said DNA sequence recognition units comprise any protein scaffold or synthetic molecular moiety capable of recognizing a specific DNA sequence.

7. The method of claim 1 wherein said stretching of said hybridized DNA complex in a random coil state to form a hybridized DNA complex in a substantially linear configuration is accomplished by using a mechanical means.

8. A method for single molecule identification of a target DNA molecule in a random coil state comprising the following steps:

- a) stretching said target DNA molecule in a random coil state to form a substantially linear configuration;
- b) attaching an optically distinguishable material to a DNA sequence recognition unit;
- c) hybridizing said DNA sequence recognition unit to said target DNA molecule in a substantially linear configuration to form a hybridized DNA complex in a substantially linear configuration; and
- d) detecting said optically distinguishable material in a sequential manner along said substantially linear hybridized DNA complex, thereby identifying said target DNA molecule.

9. The method of claim 8 wherein said optically distinguishable material comprises colored microparticles.

10. The method of claim 8 wherein said optically distinguishable material comprises microparticles having different shapes.

11. The method of claim 9 wherein said colored microparticles comprise dyes, dye aggregates, pigments or nanocrystals.

12. The method of claim 8 wherein said DNA sequence recognition unit comprises DNA, DNA fragments, synthetic oligonucleotides or peptide nucleic acids.

13. The method of claim 8 wherein said DNA sequence recognition units comprise any protein scaffold or synthetic molecular moiety capable of recognizing a specific DNA sequence.

5 14. The method of claim 8 wherein said stretching of said hybridized DNA complex in a random coil state to form a hybridized DNA complex in a substantially linear configuration is accomplished by using a mechanical means.